

SPECIFICATIONS
FOR
ENVIRONMENTAL SAMPLE COLLECTION
AND
ANALYSIS FOR PLUTONIUM AND AMERICIUM
ADJACENT TO
THE ROCKY FLATS PLANT
JEFFERSON COUNTY, COLORADO

Prepared By
Rockwell International
Atomics International Division
Rocky Flats Plant
P. O. Box 464
Golden, Colorado,

PROPRIETARY INFORMATION

This document contains proprietary information
of Rockwell International Corporation and is
submitted in confidence.

ADMIN RECCRD
SW-A-004003

TECHNICAL SPECIFICATIONS FOR THE
DETERMINATION OF PLUTONIUM AND AMERICIUM
ON LAND ADJACENT TO THE ROCKY FLATS PLANT

INDEX OF TECHNICAL SPECIFICATIONS

<u>Division</u>	<u>Section No.</u>	<u>Section Title</u>	<u>Page</u>
1 General Requirements	1-01	Purpose of Project	1
	1-02	Summary of Work	2
	1-03	Drawings	4
	1-04	Time Requirements	5
2 Sample Collection and Preparation	2-01	Sample Site Locations	6
	2-02	General Procedures	10
	2-03	Soil Samples per Rockwell International Technique	13
	2-04	Soil Samples per Colorado Dept. of Health Technique	16
	2-05	Soil Samples per Jefferson County Health Department Technique	18
	2-06	Collection of Vegetation Samples	20
3 Sample Analyses	3-01	Analysis of Soil for Plutonium and Americium	21
	3-02	Analysis of Vegetation Samples	23
4 Quality Control	4-01	Quality Plan Goal	24
	4-02	Project Review and Approval	26
	4-03	Project Modification Control	27
	4-04	Document Approval	28
	4-05	Access Control	29
	4-06	Field Environment Integrity Control	30
	4-07	Material Identification and Control	31
	4-08	Sample Handling, Shipping and Storage	32
	4-09	Equipment and Procedure Qualification	33
	4-10	Standards Traceability	34
	4-11	Personnel Training and Qualification	35
	4-12	Data Documentation and Control	36
	4-13	Problem, Failure and Nonconformance Reporting and Analysis	37
	4-14	Corrective Action Control	38
	4-15	Auditing	39
5 Data Compilation	5-01	Analytical Data Summaries	40
	5-02	Precision and Accuracy	41
6 Reports	6-01	Monthly Status Reports	42
	6-02	Final Project Report	43

SECTION 1-01

PURPOSE OF PROJECT

The purpose of this project is to make an assessment of certain parcels of land adjacent to the Rocky Flats Plant in light of allegations by plaintiffs in pending litigation that the land has been rendered unfit for human habitation and unmarketable due to the release of plutonium and americium from the Rocky Flats Plant.

SECTION 1-02

SUMMARY OF WORK

The work to be accomplished under this contract shall consist of the following major tasks:

- A. The locations of seventy-one (71) soil sample sites shall be surveyed for accuracy, marked on the ground, and plotted on a topographic quadrangle map showing the five land parcels.
- B. Soil samples shall be collected at each site by three different techniques. These will be the methods recommended by Rockwell International, The Colorado Department of Health, and The Jefferson County Health Department.
- C. Soil samples shall be collected by the three sampling techniques at five (5) background sites. The locations of these sites will be selected by the contractor and approved by Rockwell International.
- D. Vegetation in each land parcel shall be sampled at locations to be selected after soil sample analyses are complete.
- E. All samples shall be analyzed for plutonium and americium. Radiochemical procedures utilizing appropriate tracer radioisotopes shall be required.

- F. Analytical data shall be reported for each land parcel as soon as practicable. A final report shall include tabulations of all data plus evaluations of analytical precision and accuracy.

SECTION 1-03

DRAWINGS

The drawings required for this project are:

<u>Drawing No.</u>	<u>Title</u>
D 18789-2*	Rocky Flats Plant and Surrounding Area Contours Soil Sampling Plan

* It may be desirable to substitute U. S. Geological Survey 7.5 minute quadrangle map of Louisville, Colorado, dated 1965 and photorevised 1971.

SECTION 1-04

TIME REQUIREMENTS

It shall be necessary to complete this project within six months of initiation. Critical time requirements are those assignments necessitating access to private lands. These assignments are site survey, soil collection, and vegetation sampling. It is estimated that locating and staking 71 sample sites will require 10 working days. Collection of soil samples will require 20 working days and vegetation sample collection will take five working days. These estimates are for actual working time. Adverse weather conditions could cause the total elapsed time to be much longer.

SECTION 2-01

SAMPLE SITE LOCATIONS

The 71 sample sites, shown on Drawing D 18789-2 and described later, shall be located, staked, and marked on the ground by a professional licensed surveyor and crew. It may be necessary to deviate slightly from the indicated map sites, depending upon the location of roads, canals, fences, etc. The necessary requirement is accurate correlation between ground site and map location. Color photographs shall be obtained at each sample site at the time of sample collection in order to depict general topography, surface conditions, and type of vegetation.

In the event that deviation from an indicated map site is necessary, the sample site selected shall be proximate to the indicated site and shall be selected according to the criteria for site selection suggested by the Nuclear Regulatory Commission in Regulatory Guide 4.5. The guide states, "the site should be nearly level with moderate to good permeability. There should be little or no runoff during heavy rains and no overwash at any time. Such a site is frequently found on smooth ridge crests, level virgin land, and well kept lawns and grounds around institutional buildings. The site should not be near enough to buildings or trees to be sheltered during blowing rains. Soils having high earthworm activity should be avoided because of uneven mixing of the soil to considerable depths."

Sample sites shall be marked on the ground with an appropriately identified stake or marker showing map location

and site number. These stakes shall be removed at the conclusion of the project at the request of each land owner. These sites shall be considered to be the centers of 10 metre diameter areas for sample collection.

Procedures for locating the sample sites in each land parcel are given in the following paragraphs.

Great Western Ventures Property

T2S, R69W Section 6, Five Sites

The starting point is the southwest corner of section 6. Proceed east along the southern boundary of the section for 1320 feet, then north 770 feet to site No. 1. Next proceed north 770 feet to site No. 2, then east 1320 feet to site No. 3. Site No. 4 is 770 south of site No. 3, and site No. 5 is 1320 feet east of site No. 3.

Good and Associates Property

T2S, R69W, Sections 7 and 18, Twenty Sites

The starting point is the southwest corner of section 18. Proceed east along the southern boundary of the section for 880 feet, then north 660 feet to site No. 1. Sites 2 through 8 are located north of site No. 1, equally spaced, 770 feet apart. Site No. 9 is 880 feet east of site No. 1. Sites 10 through 16 are located north of site No. 9, equally spaced, 770 feet apart.

To locate sites 17 through 20 start at the southeast corner of section 7. Proceed west along the southern boundary of the section for 1100 feet then north for 660 feet to site No. 17. Next proceed 1100 feet west to site No. 18. Next

proceed north for 660 feet to site No. 19. Site No. 20 is 1100 east of site No. 19.

Church Properties

T2S, R70W, Section 24, Sixteen Sites

The starting point is the northeast corner of section 24. Proceed west along the northern boundary of the section for 528 feet, then south for 528 feet to site No. 1. Sites 2 through 16 are located on a square grid at equal spacings of 528 feet.

T2S, R70W, Section 23, Twenty Sites

The starting point is the southeast corner of section 23. Proceed west for 770 feet, then north 770 feet to site No. 1. Sites 2 through 20 are located on a rectangular grid with east to west spacing of 1100 feet and north to south spacing of 990 feet.

T2S, R70W, Sections 21 and 22, Six Sites

The starting point is the northwest corner of section 21. Proceed east for 1540 feet, then south for 660 feet to site No. 1. Sites 2 through 4 are located on a straight line east of site No. 1 at equal distances of 2200 feet. Site No. 6 may be located by proceeding west for 550 feet from the southeast corner of section 21 along the southern boundary of the section, then 1320 feet north. Site No. 5 is 1320 feet north of site No. 6

T2S, R70W, Section 9, Four Sites

The starting point is the northwest corner of section 9. Proceed east along the northern boundary of the section for 550 feet, then south for 1100 feet to site No. 1. Sites 2 through 4 are located on a straight line south of site No. 1 at equal distances of 990 feet.

SECTION 2-02

GENERAL PROCEDURES

Soil samples shall be collected at each site by a crew of at least three technicians plus professional supervision. Each technician, sampling by one of the three specified methods, shall receive or have had a minimum of four hours training in that soil collection technique. Descriptions of these techniques are presented in subsequent sections. All deviations from the procedures described herein shall be documented in a sample collection log book.

The plan of operation at each soil sample site shall be uniform and shall be recorded in a log book. It is recommended that samples by the Rockwell technique be collected 0.3 metre north of the center point of each site and at the four cardinal points at a distance of five metres from the site center. The sample collected by the Jefferson County Health Department technique should be taken in the southeast quadrant in a square two metres on a side at a distance of two metres from the site center. The samples collected by the Colorado Department of Health technique should be taken in the other three quadrants. Four corners of a two metre square and the center should be sampled in each quadrant.

The sample collection log book shall contain the following information:

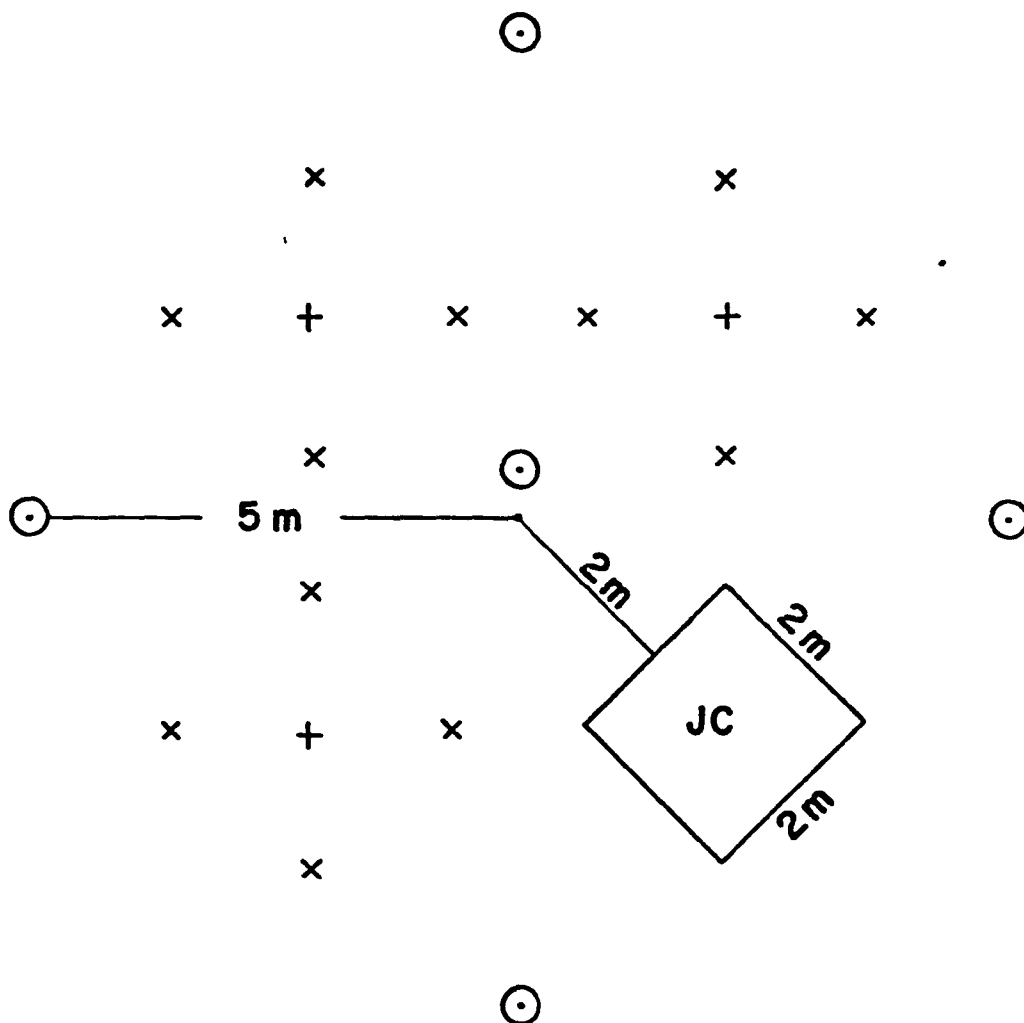
- (a) Sample number
- (b) Sample location

- (c) Date of collection
- (d) Name and signature of sample collector
- (e) Weather conditions
- (f) Soil type (general, i.e., gravel, sandy, loam)
- (g) Vegetation
- (h) Degree of slope and direction
- (i) Soil moisture
- (j) Any special conditions

It is anticipated that observers from the Colorado Department of Health and the Jefferson County Health Department will accompany the sample collection team during some or all of the field operations. Representatives of the plaintiffs (land owners) may also observe sample collection operations.

Copies of a soil survey map of Rocky Flats by the U. S. Soil Conservation Service will be available upon request.

SOIL SAMPLE PLAN



SCALE: 1 INCH = 2 METRES

LEGEND

- ⊙ ROCKWELL INTERNATIONAL SAMPLE
- + COLORADO DEPARTMENT OF HEALTH SAMPLE
- JC JEFFERSON COUNTY HEALTH DEPARTMENT SAMPLE

SECTION 2-03

SOIL SAMPLES PER ROCKWELL INTERNATIONAL TECHNIQUE

Two composite soil samples shall be collected at each site. These composites shall consist of five surface samples (0 to 5 centimetre depth) and five subsurface samples (5 to 20 centimetre depth) at the same five locations. Surface soil shall be taken using a sampling jig which outlines an area 10 by 10 centimetres. A prototype sample jig will be available from the project manager. The jig shall be driven into the ground to a depth of five centimetres which will cut three sides of the sample. A scoop shall be used to finish cut the fourth side and to remove a five centimetre deep section. Subsurface samples (cores) shall be taken with an 8.3 centimetre diameter barrel auger that cuts an 8.9 centimetre diameter sample. The cores shall be collected at the same sites as the surface samples after the latter have been taken.

In very rocky areas, good sample geometry (shape) may not be achievable with the jig. In these cases, the jig and metric ruler shall be used to gauge the desired sample size. Rocks and soil will be pried or chiseled from place for collection. The five surface samples shall be composited in an unused metal paint can, and the can lid will be sealed immediately with sealing wax. The five subsurface cores shall be collected in the same five holes, composited in a separate unused metal paint can, and the can lid shall be sealed immediately with sealing wax. The sample containers shall be labeled with the sample number, sample location, date, and signature of sampler.

The procedure for collecting both surface and subsurface soil samples is described below.

1. Surface Samples

- a. Place the sample jig on the ground, and using a wood block and hammer, drive the jig into the soil to a depth of five centimetres.
- b. With minimal disturbance to the soil inside the jig, use a scoop, trowel or chisel to remove the soil from around the open side of the sample jig. Soil should be removed to a depth which will allow easy removal of the sample.
- c. Discard the soil removed from outside the jig and thoroughly clean the sampling tools to prevent cross contamination of samples.
- d. Remove the soil sample from the interior of the jig with a scoop or trowel and place it in a new paint can. Seal the can immediately.
- e. Clean the sample jig and all sampling tools prior to moving to another sample site.

2. Subsurface Samples

- a. Place the auger carefully in the hole made by removal of the surface sample and cautiously rotate the auger handle to prevent caving of the walls of the hole. A slight downward pressure with slow turning will guide the auger.
- b. When the auger cylinder is about 3/4 full, remove the auger slowly and either tap out or scrape out with a spatula the soil core. If rocks or roots impede the auger, it may be possible to carefully cut them out of the hole and include them with the total sample. Place the sample in a new paint can and seal the lid.

- c. Fill each hole to the top with excess soil to prevent an accident.

Prior to analysis, each soil sample shall be placed in a stainless steel pan and oven dried at 110°C to constant weight. After drying, the samples shall be weighed and the bulk density shall be measured and recorded. The sample shall be sieved through a 10 mesh (2 millimetre) screen. Oversize material shall be weighed and discarded. The minus 10 fraction shall be weighed, placed in a ball mill and ground to a homogeneous fine powder. One-hundred gram portions of this powder shall be packaged and sealed. One such portion shall be submitted to the Analytical Laboratory for specific plutonium and americium analysis. The balance of the sample shall be retained by the contractor until disposal orders are issued by the project manager.

Sample preparation, shipment, and receipt by the laboratory shall be certified and recorded.

SECTION 2-04

SOIL SAMPLES PER COLORADO DEPARTMENT OF HEALTH TECHNIQUE

Fifteen individual soil samples shall be collected at each site using a soil sampling device with the dimensions 5 by 6 by 0.6 centimetres. A sample device will be available from the project manager. This device effectively samples the top 0.3 centimetres of soil. Each of the individual samples shall be collected at the four corners and the center of a two metre square.

The procedure for collecting each soil sample is described below:

1. Place the sampling device on the ground and force it into the soil to a depth of 0.6 cm.
2. Drag the scoop across the surface of the soil within the outlined area with the handle of the scoop at a 45 degree angle.
3. Collect the soil at the rolled end of the template and transfer to a new paint can.
4. Repeat Step 2 until the entire soil sample has been removed to a depth of 0.3 cm.
5. Clean the sampling device thoroughly and move to the next sample location.
6. After the 15 subsamples have been collected and placed in one new metal paint can, seal the lid immediately.

The fifteen individual samples shall be composited in one unused metal paint can and the can lid will be sealed immediately with sealing wax. The sample container shall be

labeled with the sample number and/or sample location, date, and name of sampler. The composite sample shall be later dried at 110°C to constant weight and sieved through a 10 mesh screen. Oversize material shall be weighed and discarded.

The minus 10 mesh fraction shall be weighed, coned, and quartered, then finely ground and mixed in a ball mill. One-hundred gram portions of the fine powder shall be packaged and sealed. One such portion shall be submitted to the Analytical Laboratory for specific plutonium and americium analysis according to Section 3-01. The balance of the sample shall be retained by the contractor until disposal orders are issued by the project manager.

Sample preparation, shipment, and receipt by the laboratory shall be certified and recorded.

SECTION 2-05

SOIL SAMPLES PER JEFFERSON COUNTY
HEALTH DEPARTMENT TECHNIQUE

At each sample site an area of four square metres shall be marked off. The surface dust in the delineated area shall be brought together and collected with a clean brush into a clean plastic container or bag. The sample shall include dust no deeper than five millimetres below the surface. The collected dust shall be sieved through a 10 mesh (2 millimetre) screen in the field until about 1000 grams of minus 10 mesh material are obtained. It may be necessary to sample from more than one four square metre plot. If this occurs, locate and describe in the sample log book.

The plus 10 mesh material will be saved for subsequent weighing.

The minus 10 mesh material will be saved for subsequent treatment. Each sample shall be placed in a unused metal paint can and sealed immediately with sealing wax. The sample container shall be labeled with the sample number, sample location, date, and signature of sampler.

Prior to analysis, each sample shall be dried at 110°C to constant weight. Each sample shall be weighed and the bulk density measured and recorded. Each sample shall be transferred to 100 gram packages and sealed. A sufficient number of these packages shall be utilized to obtain about 10 grams of dust particles five microns in size or smaller. The balance of 100 gram packages shall be retained by the contractor until disposal orders are issued by the project manager.

Each sample shall be passed through a series of sieves and filters to isolate dust particles five microns in size or smaller. A water suspension method may also be used to separate dust particles five microns in size and smaller. The objective in sample preparation is to disperse the microaggregates as completely as practical to expose the plutonium as individual particles.

Each sample shall be treated with 10 ml increments of 30 percent hydrogen peroxide as necessary and heated on a steam bath for 24 hours to oxidize the organic material, particularly that which exists as coatings and cementing agents. Each sample shall then be washed and filtered to remove soluble salts and dispersed with a 300 watt ultrasonic probe for 15 minutes.

Particle fractionation shall be performed by the standard water-sedimentation technique as described by Day*. Small amounts of sodium metaphosphate may be added when necessary to avoid flocculation. The five micron and smaller material shall be freeze dried, packaged, and sealed.

Portions of each dust sample shall be submitted to the Analytical Laboratory for specific plutonium and americium analysis according to Section 3-01. Any sample remainder shall be retained by the contractor until disposal orders are issued by the project manager.

Sample preparation, shipment, and receipt by the laboratory shall be certified and recorded.

* Day, P. R., "Particle Fractionation and Particle Size Analysis" in Methods of Soil Analysis Part I by C. A. Black, Madison, Wisconsin, Amer. Soc. of Agronomy, Inc. 1965.

SECTION 2-06

COLLECTION OF VEGETATION SAMPLES

Vegetation samples shall be collected from a minimum of ten locations. The location of the sample sites and time of collection will be made by the project manager after the analysis for plutonium in the soil samples. Vegetation to be sampled shall include grasses and crops, such as wheat. Only the above ground portion of the plant shall be collected. Roots will not be sampled.

Adequate vegetation to yield a sample of about 10 grams ashed weight shall be collected. This will require clipping grass from an area of 0.25 square metres or cutting about 10 litres of other vegetation. Vegetation samples shall be stored for shipment to the laboratory in sealed punctureproof containers.

All vegetation samples shall be dried and ashed at constant weight for analysis according to Section 3-02.

SECTION 3-01

ANALYSIS OF SOIL FOR PLUTONIUM AND AMERICIUM

Soil samples shall be analyzed for $^{239,240}\text{Pu}$, ^{238}Pu , and ^{241}Am .

The method of analysis for plutonium shall be that specified in AEC Regulatory Guide, 4.5. A substitute analytical procedure for plutonium may be proposed for acceptance by the project manager. Isotopic tracers (^{236}Pu and ^{243}Am) shall be added to each sample prior to dissolution in order to determine chemical recovery in the separation procedure. Recoveries shall be at least 50% in every case. Recoveries less than 50% shall necessitate sample re-analysis. The same sample solution shall be analyzed for both plutonium and americium. Plutonium and americium shall be isolated, purified, electrodeposited onto a metal disc and analyzed by alpha spectrometry. Any recommended modification shall be approved in writing by the project manager.

A radiochemical method for americium shall be proposed for acceptance by the project manager.

A minimum of 10 grams of each sample shall be analyzed.

The sensitivity of each analysis shall be 0.01 d/m/g.

Each batch of 40 analyses shall include a minimum of four blank samples and two blank plus spike samples. If any result from a blank or spike deviates more than +25% from known values, the entire batch shall be re-analyzed.

The precision of each analysis shall be less than $\pm 25\%$ and the exact values shall be reported, such as 0.15 ± 0.03 d/m/g. Standard plutonium-in-soil samples shall be analyzed as they become available during the duration of the project. Demonstrated accuracy of analyses from standards and spikes shall be better than $\pm 50\%$.

SECTION 3-02

ANALYSIS OF VEGETATION SAMPLES

Vegetation samples shall be prepared for analysis for plutonium and americium according to the method described by Major et al in NVO-142, page 107, 1974. Any deviations from this method shall be approved in writing by the project manager.

Radiochemical analysis of the dissolution solutions shall be performed by accepted procedures using isotopic tracers (^{236}Pu and ^{243}Am) approved by the project manager. Tracer recovery shall be 50% or greater. Sufficient amount of solution shall be taken to provide sensitivities of at least 0.01 d/m Pu or Am/g dry ash.

Each batch of ten analyses shall include a minimum of one blank sample and one blank plus spike sample. If results from blanks or spikes deviate more than $\pm 25\%$ from known values, the entire batch shall be re-analyzed.

The precision of each analysis shall be less than $\pm 25\%$ and the exact values shall be reported, such as 0.15 \pm 0.03 d/m/g.

SECTION 4-01

QUALITY PLAN GOAL

The goal of a quality plan is to assure that information of the highest attainable precision and accuracy is obtained in the investigation, through pre-planned control of all project elements which may directly or indirectly, have an impact on the integrity of the information derived from the investigation.

It shall be the responsibility of the contractor to prepare and utilize complete quality assurance and quality control programs. These programs shall be approved by the project manager before the project may proceed.

Certification shall mean that for any item under the contract that requires certification the following shall apply:

- A. The operation or procedure shall be conducted, performed or observed by an individual designated in writing as certifying personnel by the contractor prior to commencement of performance of the contract. More than one such person may be designated for any given operation or procedure, but the number of certifying personnel for any given operation or procedure shall not exceed three.
- B. The contractor shall submit a list of certifying personnel for each item requiring certification under this contract to the project director for approval prior to commencement of performance of this contract.
- C. Certifying personnel shall have a minimum of two hours instruction on their duties as certifying personnel under

this contract prior to commencement of performance of this contract.

- D. For each item requiring certification under this contract, certifying personnel shall witness that operations or procedures are performed in accordance with the requirements of this contract and that records or documents which require certification are true and accurate.
- E. Certification shall be by date and signature in ink. The name of the certifying personnel shall appear beneath the signature either printed by hand or typed.
- F. Each page of a record wherein entries requiring certification are made shall be certified in accordance with (E) above.

Procedures for maintaining chain of custody of samples and records shall be in accordance with instructions from the project manager.

SECTION 4-02

PROJECT REVIEW AND APPROVAL

It shall be necessary that Rockwell International project management is aware of all facets of project implementation through review and approval of all procedures.

SECTION 4-03

PROJECT MODIFICATION CONTROL

- There shall be no deviation from any phase of the documented plan of action, as described in procedures or other project documentation, without the written approval of the Rockwell International project manager or his designated representative.

SECTION 4-04

DOCUMENT APPROVAL

The signature of the Rockwell International project manager or his designated representative shall be on the cover sheet of each document prepared to implement the policies and procedures required by the project. Approval shall be obtained prior to document release.

SECTION 4-05

ACCESS CONTROL

Access permits to the land under litigation shall be obtained by Rockwell International prior to initiation of the project.

Access to other sites for the purpose of collecting background samples shall be obtained by Rockwell International.

Sample site access control on personnel, equipment, and livestock to prevent unnecessary disturbance which may adversely effect the sample collection program shall be maintained.

SECTION 4-06

FIELD ENVIRONMENT INTEGRITY CONTROL

All activities at the sample sites shall be conducted in a manner which produces the least damage to the environment and maximum protection of the integrity of the samples.

SECTION 4-07

MATERIAL IDENTIFICATION AND CONTROL

Sample identification shall be required in order to permit traceability of each sample and its related data from the point of identification on a map through sample collection, analysis, and reporting. The quality plan shall include detailed procedures for sample identification and certification by contractor on all procedures.

SECTION 4-08

SAMPLE HANDLING, SHIPPING, AND STORAGE

The integrity of all samples shall be maintained during sample collection, packaging, shipping, storage, preparation, and laboratory processing. The contractor shall certify the integrity of samples at each process identified herein.

It shall be the responsibility of the contractor to protect each sample at all phases of the project in order to avoid alteration of the chemical composition, or other characteristics, through introduction of extraneous materials or extraction or alteration of the sample or its components.

SECTION 4-09

EQUIPMENT AND PROCEDURE QUALIFICATION

All equipment used for sample site location, sample collection, and sample analysis shall be calibrated or otherwise certified as suitable as per written standard procedures for use before start-up. Such certification shall be maintained throughout the duration of the project.

The determination shall be made, prior to project start-up, that methods and equipment will yield information of a known precision and accuracy.

All operating procedures shall be submitted for written approval by the Rockwell International project manager.

All laboratory equipment shall be carefully calibrated and maintained with records of each calibration or maintenance action kept in appropriate log books. Certified standards shall be used for all primary calibrations.

All isotopic tracers used for recovery determinations (^{236}Pu , ^{242}Pu , or ^{243}Am) shall be accurately standardized against an absolute basis. The precision of the standardization shall be less than $\pm 1.5\%$. The ^{236}Pu tracer shall have a ^{238}Pu impurity less than 0.5% alpha activity and have a ^{239}Pu impurity less than 0.1% alpha activity.

The laboratory shall have a specific quality control program to assure analytical precision and accuracy. This program shall be approved by the project manager.

SECTION 4-10

STANDARDS TRACEABILITY

All standards used in the radiochemical procedures shall be traceable to primary standards, preferably NBS standards. Standards shall be used to determine yield in all chemical recovery procedures. Radiometric standards shall be used to determine alpha counter geometry factors. Radiometric standards shall be used to determine the reliability of radiometric instrumentation. Statistical analysis, such as the chi-square test shall be used to determine reproducibility of count measurements.

SECTION 4-11

PERSONNEL TRAINING AND QUALIFICATION

It shall be the responsibility of the contractor to provide qualified, trained personnel. It shall be necessary that all personnel are fully informed of the specific nature of the tasks for which they are responsible. All personnel shall have the capability of performing the required tasks in a manner commensurate with the requirements of the project.

SECTION 4-12

DATA DOCUMENTATION AND CONTROL

There shall be a systematic and documented identification, recording, collecting, and reporting of project data in a manner which will assure traceability and integrity of information.

All procedures shall be documented in a procedures manual. Each procedure shall include quality control features that are unique to that procedure. Procedures shall be changed only after appropriate review and approval.

SECTION 4-13

PROBLEM, FAILURE, AND NONCONFORMANCE
REPORTING AND ANALYSIS

It shall be the responsibility of the contractor to document and report any unplanned event having an impact on the project or any variance from a procedure. The event or variance shall be analyzed and a statement of its significance shall be submitted to the project manager.

SECTION 4-14

CORRECTIVE ACTION CONTROL

All decisions by the project manager or his designated representative concerning any problem, failure, or nonconformance shall necessitate appropriate action by the contractor.

SECTION 4-15

AUDITING

All project activities shall be subject to audit by the project manager or his designated representative.

Results of auditing will be reported by project management and corrective action shall be taken as necessary.

SECTION 5-01

ANALYTICAL DATA SUMMARIES

Tabulations of all analytical results shall be submitted for review as soon as each block of samples is analyzed. For the purposes of this specification, a block is defined as the total number of soil or plant samples from a single land parcel. For example, there will be a block of 60 soil samples from land Section 23. This block of sample data shall be accompanied by additional data on blanks, spikes, duplicates, and standard samples.

Data to be reported shall include isotope concentration in d/m/unit size plus precision limits plus tracer recovery percentage.

SECTION 5-02

PRECISION AND ACCURACY

All analytical results shall include specific data on precision and accuracy.

Precision data shall be obtained and reported by counting reference sources daily to determine instrument stability.

Precision data shall be obtained by the analysis of duplicates. The results of duplicate analysis shall be evaluated and reported.

Accuracy data shall be derived from the analysis of standard samples and spiked samples. Accuracy data shall be obtained and reported from the analysis of standard reference samples. It is anticipated that an EPA plutonium-in-soil standard may be available during the project time period. Other environmental standards probably will not be available.

SECTION 6-01

MONTHLY STATUS REPORTS

The contractor shall provide monthly status reports. These reports shall include information on progress to date, and evaluations of problems, failures, and nonconformance events.

SECTION 6-02

FINAL PROJECT REPORT

The contractor shall provide a final project report within 30 days of completion of all analyses.

The final project report shall include complete descriptions of all procedures used in the project, tabulations of all analytical data, including precision and accuracy analyses, and maps and charts showing locations of all sample sites and concentrations of all radionuclides requested in previous sections.

The final report shall contain certification of the accuracy of site locations, correlation between site location and identified samples of soil and vegetation, integrity of samples from time of collection through time of analysis, and integrity of analytical results.

ADDENDUM - I

CORRECTIONS AND ADDITIONS TO "SPECIFICATIONS
FOR ENVIRONMENTAL SAMPLE COLLECTION AND ANALYSIS
FOR PLUTONIUM AND AMERICIUM ADJACENT TO THE
ROCKY FLATS PLANT, JEFFERSON COUNTY COLORADO"

Contractor will not perform any vegetation sampling or analysis unless authorized by the Project Manager.

Page 10, paragraph 2, line 13, add new sentence:

"The sequence of sampling shall be as follows: (1) The Jefferson County technique shall be used first; (2) The Colorado Health Department technique shall be used second; and (3) The Rockwell International technique shall be used third at all locations."

Page 11, new paragraph: "Sample collection tools shall be cleaned after each sample is collected in such a manner as to prevent cross-contamination of samples."

Page 14, No. 2(a) after "the surface sample", insert:
"with the jig still in place, to prevent contamination of the core sample by surface material, and cautiously rotate . . ."

Page 15, line 8, "weighed and discarded", change to read as follows: "weighed and reserved for possible special analysis. Twenty-five of these samples shall be acid washed and the washings shall be analyzed for plutonium as specified in Section 3-01."

Page 15, line 9, "placed in a ball mill," change to read as follows: "transferred to a one-gallon metal paint can containing 10 one-inch diameter forged manganese steel grinding balls, placed in a ball mill and rotated at 120 rpm for at least four hours. The sample and the steel balls shall be retained in the same paint can for the duration of the project."

Page 15, line 13, change to read as follows: plutonium and americium analysis only as requested by the Project Manager.

Page 15, line 4, page 17, line 3, and page 18, paragraph 4, line 2: All references to bulk density calculations refer to field bulk density, to be obtained by dividing the total sample weight by the estimated total volume of the sample in the field.

Page 17, line 3, should read as follows: dried at 110°C to constant weight, bulk density calculated, and sieved through a 10 mesh screen.

Page 18, first sentence should read as follows: "At each sample site a square area two meters on a side shall be marked off."

Page 21, line 6, "Isotopic tracers (^{236}Pu and ^{243}Am)" should read "Isotopic tracers (^{236}Pu or ^{242}Pu and ^{243}Am)."

Page 21, third paragraph, should read as follows:

"A method for americium determination in soil shall be proposed for acceptance by the Project Manager."

Page 21, sixth paragraph, line 3, delete the words

"blank or."

Page 22, first sentence should read as follows: "The analytical precision shall be better than $\pm 25\%$. Sufficient replicate analyses shall be performed to establish analytical precision."

Page 22 add paragraph 2: "A standard method for the determination of fractional error in the value of the radioisotope being measured shall be used. The method described by R. J. Overman and H. M. Clark in Radioisotope Techniques, McGraw Hill, NY, NY, 1960 p. 109 is satisfactory."

Page 31, line 4 add sentence: "Sample identification shall be coded to prevent direct association between samples and sample locations."

Page 40, paragraph 2, line 2 should read as follows:

"d/m/g for soil and d/m/m³ for air. Analytical results below the detection limit shall be reported as less than values and not the actual numerical value. The error

propagation values from counting statistics and the tracer recovery percentages shall be reported for each analysis."

Page 40, add paragraph 3: "All data records shall be kept in the raw or as measured form and shall be available to the Project Manager upon request."

Page 41, paragraph 3, line 3, add the sentence: "The results obtained from duplicate analyses shall be averaged for inclusion in each block of sample data."

Page 41, paragraph 4, the next to last sentence should read as follows: "It is anticipated that an EPA plutonium-in-soil standard sample may be available during the project time period."

Page 41, paragraph 4, the last sentence is to be deleted and add the following: "Approximately 32 plutonium-in-soil standards and 32 americium-in-soil standards prepared by Rockwell International shall be analyzed by the contractor. At least ten unidentified blanks will also be submitted along with the standards for plutonium and americium analysis."

ADDENDUM - II

"SPECIFICATIONS FOR ENVIRONMENTAL SAMPLE COLLECTION
AND
ANAYLSIS FOR PLUTONIUM AND AMERICIUM ADJACENT TO THE
ROCKY FLATS PLANT, JEFFERSON, COUNTY, COLORADO"

SAMPLE SITE LOCATIONS - REVISION

A preliminary survey shall be conducted by a licensed surveyor and crew to locate each of the 71 sample sites. Each site will not be marked by a central stake, but will have accurately located reference points. These reference points will allow location of the actual site by a final survey immediately prior to soil sample collection.

Description of the reference points and data related to sample sites shall be treated as confidential information by the survey chief and shall not be released without written authorization by the project manager.